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THE MARKET FOR WOOD PALLETS IN THE AUTO INDUSTRY;--

A Case Study of Ford Motor Company

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The Market for Wood Pallets in the Auto Industry —

A Case Study of the Ford Motor Company[1]

by

Charles F. Sutherland, Jr.[2]

• • • SUMMARY

The automotive pallet industry is a large consumer of low-grade hardwoods in Michigan. About 4,810,000 board feet of hardwoods and 450,000 board feet of pine were used in 1956 to supply Ford Motor Company with pallets. Approximately 2.7 board feet of wood were consumed in pallets for every vehicle Ford produced.

Hardwood and pine lumber purchased for pallets from Southern mills usually passes through the lumber broker's hands. In the North, hardwood lumber is purchased by the pallet manufacturer directly from the sawmill. Many pallet manufacturers own or have an interest in one or more sawmills in Michigan.

Pallets are usually sold directly to the auto company by the pallet manufacturer. Occasionally a large pallet manufacturer acts as a wholesaler and buys from small pallet makers.

Automobile companies are careful to select reliable suppliers with the plant capacity and willingness to give excellent service. Pallet prices among the approved suppliers are very competitive.

The consumption of pallets per vehicle is not expected to change materially in the next few years. However, an increase in total use is expected as auto and truck production expands.

• • • INTRODUCTION

Forest managers are actively seeking new markets for the surplus of low-grade hardwoods in the Lake States Region. To aid this effort, the Lake States Forest Experiment Station has investigated a number of possible outlets including the automotive pallet industry.

According to some forest products suppliers, more low-grade hardwood lumber (mainly grade 3) is used in Michigan for pallets than for any other single use. An excellent market for low-grade hardwoods is provided by the pallet makers serving the automobile industry. Auto companies have enthusiastically adopted the pallet and planned their buying policies, plant designs, and packaging to take advantage of the money saved in material handling.

This descriptive study of the automotive pallet industry is a part of a complete examination of the wood products industries' relations with Ford Motor Company.[3] The data in this report apply specifically to pallet manufacturers serving Ford,

[1] *This study was made with the help and cooperation of Ford Motor Company and many of its pallet suppliers.*

[2] *Member of the Staff of the Lake States Forest Experiment Station, Forest Service, U. S. Department of Agriculture, at the time this study was made; now on the forestry staff of Oregon State University.*

[3] *Sutherland, Charles F., Jr. Consumption and Marketing of Forest Products in the Automobile Industry. Ph.D. thesis, 280 typed pages. University of Michigan, Ann Arbor, 1960.*

but observations of marketing methods and purchasing policies generally apply to most pallet manufacturers supplying the auto industry. However, some special relationships may exist between the small manufacturer of auto parts and the small pallet manufacturer.

The objectives of this study were to indicate:

1. The consumption of low-grade hardwood lumber in automotive pallets by Ford Motor Company.

2. The distribution channels used to market these pallets and the services and marketing functions, including buying and selling, transportation, and storage, performed by marketing agents or pallet manufacturers.

3. The future trends in consumption and marketing that may be expected for pallets.

WHAT IS A PALLET? • • •

A pallet is a raised platform, usually made of wood, but occasionally made of paperboard or metal (fig. 1). It is used in handling heavy or bulky materials by machinery with a minimum of hand labor. In the auto industry packaged or individual parts are placed on a pallet and moved by forklift or other conveyance from a truck or railroad car to storage or to the production line in assembly plants.

Pallets were introduced into Ford plants in 1942. Corrugated cartons piled on pallets replaced the nailed wooden box and eliminated much of the wood used in shipping. With proper machine operation, loads could be handled without damage, reducing the need for heavy wood packaging. Pallets could also be re-used several times; nailed boxes or crates were not so durable.

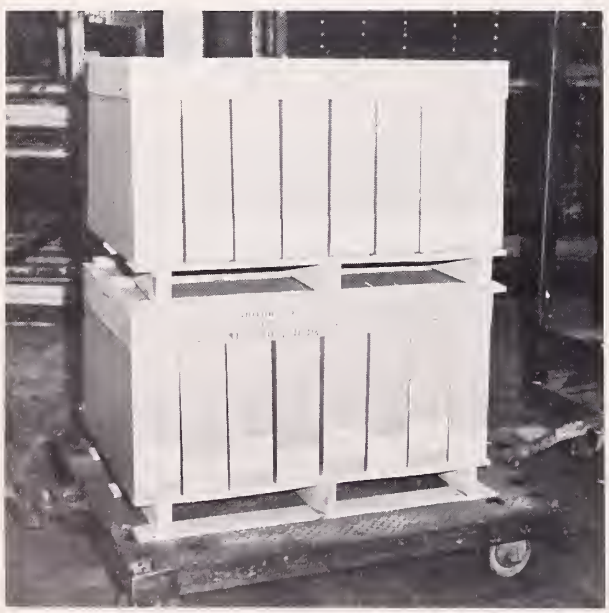

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FIGURE 1. — Warehouse pallets loaded with packaged automobile components.

Some Are Expendable

Essentially there are two kinds of pallets — the expendable and the re-usable or warehouse pallet. The expendable pallet is made from green hardwood lumber of thin dimensions. This pallet is, as the name implies, specifically designed to last for a one-way trip between two stages in the manufacturing process. The warehouse pallet, on the other hand, is a re-usable pallet with an average life in the auto industry of perhaps 3 years. It may be made of green or dry lumber (mainly hardwoods).

Many Are Tailormade

A standard size for both expendable and warehouse pallets in the auto industry is 48x48 inches with a 3½-inch clearance. However, pallet sizes are seldom standard. The auto industry ships parts of all shapes and sizes, and pallets must be especially designed to carry these loads. Container and pallet construction are greatly influenced by the method of transportation; the shipper attempts to maximize the number of parts per cubic foot of shipping space to reduce shipping charges. The size of storage racks and the amount of storage space in the assembly plants affect pallet size too. The final product is a pallet designed to best meet the requirements of the auto company's material handling operation.

The construction of warehouse and expendable pallets of the same type differs mainly in the size

and quantity of lumber used. The warehouse pallet, made of several 2x4 runners and some 1-inch lumber for decking, averages about 28 board feet of lumber. The expendable pallet, averaging approximately 10 board feet per unit, uses six or nine 4x4 blocks and ⅜- to ½-inch lumber for decking.

The deck (top) boards in warehouse pallets are usually surfaced on one side to insure uniform thickness. The number of these boards used depends on the load the pallet must carry; that is, the heavier the load the greater the number of deck boards used.

• • • ABOUT THE LUMBER USED

Manufacturing and Supply Divisions Use 5 Million Board Feet

Almost 5 million board feet of low-grade hardwood lumber were consumed in making the pallets used by the manufacturing and supply divisions in the 1956 model year (table 1). An additional half-million board feet of softwood lumber were consumed for the same purpose. Only the lumber used for dunnage and fixtures in railroad cars exceeded the quantity of lumber used in pallets.

Thirty-two percent of this wood was consumed in expendable pallets (table 1). Most of these were used to move parts from manufacturing divisions to the assembly plants. Lumber from all expendable pallets was either burned or sold as scrap. Most warehouse pallets (making up 68 percent of the total lumber consumed) were used in supply depots.

An average of 2.7 board feet of lumber was consumed in pallets per vehicle produced in 1956 (1.8 in re-usable pallets and pallet boxes and 0.9 in expendable pallets).

Assembly Plants Receive Other Pallets From Parts Contractors

But the vehicle assembly plants received much more wood than can be accounted for by pallets shipped from the manufacturing and supply divisions. In a study of incinerator use in one assembly plant, material handling engineers found that the plant burned 27.5 pounds of wood per vehicle. At 3.6 pounds per board foot, this represents 7.6 board feet of wood per vehicle. Assuming that 0.9 board foot of this was in expendable pallets shipped from Ford manufacturing and supply divisions, this left 6.7 board feet unaccounted for. A major but unknown amount of this was undoubtedly made up of pallets used by contractors to ship parts to the assembly plant. At least a part of the remainder came from lumber used for dunnage, wirebound boxes, nailed boxes, and damaged warehouse pallets.

Repair for Resale Takes Some Wood

While expendable pallets are just that — expendable, — warehouse pallets are re-used and

TABLE 1. — *Wood used in pallets by Ford manufacturing and supply divisions, 1956*[1]

Type of use	Hardwood[2]	Softwood[3]	Total	
	Bd. ft.	*Bd. ft.*	*Bd. ft.*	*Percent*
Re-usable pallets and pallet boxes	3,580,000		3,580,000	68
Expendable pallets	1,233,000	450,000	1,683,000	32
Total	4,813,000	450,000	5,263,000	100
Average per vehicle manufactured	2.45	.23	2.68	

1 *Includes allowance for waste in pallet manufacture.*
2 *All hardwoods are grade 3 or better (mostly grade 3). All are group III or IV as classified in: "Boxes, Wood Wirebound (For Domestic Shipment)" Federal Specification No. NN-B-631c General Services Administration, 28 pp., 1951, see page 2. Group III hardwoods are: Black ash, pumpkin ash, black gum, white elm, soft maple, sweetgum (red gum), sycamore, water tupelo. Group IV hardwoods are: White ash, beech, birch, rock elm, hackberry, hickory, hard maple, oak, pecan.*
3 *Usually southern pine.*

in some cases used, damaged, and sold back to the pallet manufacturer. He in turn repairs the pallet and resells it to the auto or other industry. So far this repair business, operated as a sideline by a few large pallet manufacturers, has not been too successful. Its influence on pallet consumption has therefore not been significant. Unless the pallet would sell for at least $4.00 (1957 prices) it was not worth repairing. Some users purchase repair parts for their own warehouse pallets but this use of lumber is relatively small in the auto industry.

Wood Loss in Manufacture Is Small

Lumber losses incurred in manufacture by the large pallet makers vary from 3 to 10 percent depending upon the volume of business. Increased business creates a need for small wood pieces and reduces waste. Even in periods of low production, some scrap is saved and used in a high production period.

Lumber Prices Fluctuate for Several Reasons

Almost all green hardwood lumber acquired by the pallet makers comes from the Lower Michigan area. As a consequence, green hardwood lumber price fluctuations in Lower Michigan affect the pallet manufacturers markedly. These fluctuations are caused by the interactions of supply and demand, not only in the pallet industry but in other industries as well, particularly the furniture industry. The poorer grades produced in sawing lumber for furniture manufacture are frequently used for pallets.

The supply of green hardwood lumber depends in large part upon the weather. Hardwoods in Michigan are most favorably logged in the winter and in summer when conditions in the woods permit economical logging. Therefore, the supply of lumber increases in these periods, but in the late fall, weather frequently prevents logging entirely and supplies become more scarce.

Another factor contributing to the supplies available in these periods is the need for cutting hardwood logs destined for furniture production in the late summer and early fall when the logs are less likely to stain.

On the demand side increased vehicle production in the fall affects the demand for hardwood pallets. Pressure on hardwood lumber prices exerted by the auto industry begins to be felt in October and November when hardwood logs are difficult to get. Prices begin to climb until winter production increases the supply.

The situation is quite different with respect to dry hardwood lumber. Dry lumber is more expensive than green and is used only in warehouse pallets where specified. Most of this lumber is purchased in the South for a number of reasons: first, the Michigan summer season is short and only a small quantity of air-dried lumber is produced; second, the lower labor rates in the South make the lumber cheaper at the mill site; and third, much of this low-grade southern hardwood lumber is a joint product produced in the manufacture of high-grade lumber and veneer for the furniture industry. When furniture production increases, mill inventories of low-grade lumber increase, and prices tend to drop, making southern hardwoods very competitive with low-grade, dry Michigan hardwoods. In addition, the longer drying season in the South reduces the shipping weight of the lumber sufficiently to make low-grade southern hardwood competitive in the Detroit area — especially in the fall when the prices of Michigan air-dried lumber begin to climb.

Pallet manufacturers have developed two general approaches to insure a supply of materials without radical price increases during their contract period with the auto companies: they either carry a large inventory of lumber or control their source of supply by owning sawmills and, in some instances, timber.

Manufacturers of warehouse pallets made of dry lumber maintain high inventories of southern lumber.

Manufacturers of warehouse pallets made of green lumber and makers of expendable pallets generally own sawmills or make subcontracts with independent sawmills. Pallet makers operating their own sawmills find that the price of lumber can be controlled by buying from other mills when prices are low and depending entirely on their own sawmills for lumber when prices are high.

Occasionally a system of subcontracts with independent sawmills making pallets is used to supplement those made by the original contractor. This system protects the latter from unexpected

raw material price increases. However, the contractual arrangement makes it difficult to control the quality of the pallet.

Grades and Other Specifications Are Watched Carefully

Pallet manufacturers occasionally buy lumber, particularly elm, on a mill run basis; but they usually purchase by grade in random lengths and widths. Some prefer to inspect hardwood lumber before buying to make certain that the widths and lengths they need are included. Carloads of lumber from the South have on occasion had an excess of 4-foot lengths. In Michigan, inspection of the lumber at the sawmill before it is shipped can eliminate this complication.

The auto pallet industry as a whole buys grade 3 lumber produced from Group III hardwoods,[4] but a denser wood (Group IV) may be used at any time. Most manufacturers upgrade this lumber by careful sorting and selective cutting, but at least one large producer orders a No. 2 grade when buying southern hardwood lumber.

Softwood is used for a very few purposes. Its primary use is in pallets slotted and blocked to hold heavy parts snugly. Softwood is more resilient than hardwood; thus the contact between metal part and wood is improved.

Ford further specifies that the lumber used in a pallet shall have a grain divergence of 1 inch or less in 10 and knots no larger than one-third the width of the board.

Moisture in green lumber in warehouse pallets may, according to pallet manufacturers, affect the glue line in cartons resting on the boards, but materials handling personnel at Ford say this is not an important factor in the auto industry.[5] They point out that parts destined for the assembly line pass through warehouses quickly and moisture has little time to affect the cartons. In fact in 1957 Ford Motor Company developed a new set of standards which omits specifications for moisture content for lumber for all pallets including warehouse pallets.

Perhaps a more serious result of high moisture content is shrinking and warping of warehouse pallets as they dry in storage. Ford attempted to remedy this by specifying that green lumber come from certain species having a low shrinkage ratio and low warpage in drying. In addition, to prevent nails from pulling when the pallet dries, they specify that nailheads must be countersunk 1/16 inch. Most pallet manufacturers use screw nails for added strength in warehouse pallets, though they are not required by Ford.

The effort made to use green lumber stems from the higher cost of pallets made from dry lumber. Dry lumber costs more and fabrication costs are also higher. Nails are much harder to drive in dry hardwood and since most companies drive nails by hand this becomes quite a cost factor. Also dry boards will frequently split in the nailing process or later, and require repairs.

Other Materials Are Competing With Wood

Competition in the pallet industry is increasing from manufacturers using materials other than wood. Metal and paper pallet manufacturers are attempting to secure a portion of this market. So far, metal pallets have not proven satisfactory; Ford tried them and they were soon discarded, but wire mesh structural steel containers are replacing wood pallet bin boxes for some uses (fig. 2). Molded pulp pallets and corrugated paper pallets are being used successfully in some instances. While competition from pulp or paper pallets is not important as yet, certainly it is possible that new material handling methods or improved design may make them a competitive reality.

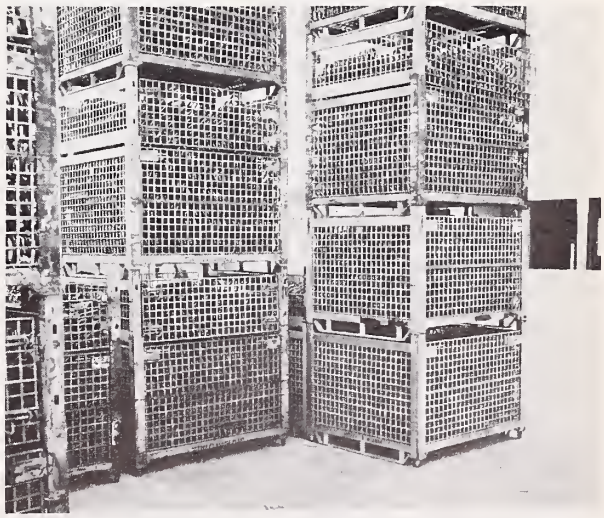

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FIGURE 2. — Wire mesh structural steel containers being used in place of wood pallet bin boxes.

[4] *See table 1 for species included in Group III or Group IV hardwoods.*

[5] *U. S. Government specifications require less than 20-percent moisture in warehouse pallets.*

GENERAL CHARACTERISTICS OF THE PALLET INDUSTRY

The pallet industry as a whole is noted for its competitive nature. The equipment necessary for pallet manufacture is negligible, and investment in raw materials is low. As a result, families may undertake pallet manufacture in slack periods or for extra income, and, with their low overhead, their prices may equal or beat those of the larger manufacturer. However, because of their small capacity and poor dependability, the small producers cannot contend for the business of the large auto companies, unless their products are purchased and resold through a large pallet manufacturer.

An outstanding characteristic of the pallet makers dealing with the auto manufacturers is their size; they are relatively large. These firms usually employ 50 or more people in their plants and have gross sales ranging from perhaps half a million to more than a million dollars in pallets alone.

In addition to pallets these plants make such related lines as bin boxes, nailed wooden boxes, skids, and many specialty wooden items for storing and shipping auto parts. At least one plant manufactures an unrelated product (prefabricated houses) which, though not using the same materials, uses the same woodworking equipment and the same experienced manpower. Such products diversify the business, making it less dependent on auto industry production.

Labor is a prime cost element in pallet manufacture in the Detroit area, contributing about 60 percent of the cost of the pallet. Because of these high labor costs, the tendency has been to limit manufacturing in Detroit to warehouse pallets and to special items with a high profit margin which may be needed quickly by Detroit auto firms.

By contrast, expendable pallets are normally made outside of the Detroit area, where lower labor rates and a location near the source of lumber supply make the best combination to meet the extreme competition in this market. To remain in the expendable pallet market, some plants with high labor costs have mechanized their construction of pallets with automatic cutoff saws and resaws and mechanical nailers.

MARKETING CHANNELS USED

Lumber may flow through several channels to a pallet manufacturer, depending upon whether the manufacturer is buying lumber from the South or from the Michigan area. If he purchases hardwoods from the South, perhaps half of his purchases from this source is made through a lumber broker and the remainder purchased directly from southern sawmills (fig. 3). Some pallet manufacturers purchase all their lumber from the South through lumber brokers.

By contrast, low-grade hardwood lumber purchased in the North is seldom bought through a broker; most pallet manufacturers make direct contact with the sawmills.

The so-called "lumber broker" may act as a real broker — that is, he may act entirely as a go-between for seller and buyer, not taking title to the lumber — or he may act as a wholesaler, purchasing the lumber from the sawmill and reselling it. He usually prefers to act as a wholesaler, billing the pallet manufacturer in his own name and concealing his source of supply. If the broker does not purchase the lumber, the sawmill bills the customer and pays the broker a commission. This provides an opportunity for the customer to buy the next shipment directly from the mill, eliminating the broker.

Many sawmills in the North and South sell to the pallet makers. These may be rather substantial, permanent mills, or small portable mills moving about the countryside and purchasing logs from farm woodlots. Some of them make pallets for pallet wholesalers under a subcontract, thereby increasing the total revenue for the mill and assuring an outlet for their low-grade hardwood lumber.

Not only may a sawmill produce pallets as a sideline, but as previously noted (page 4), a large

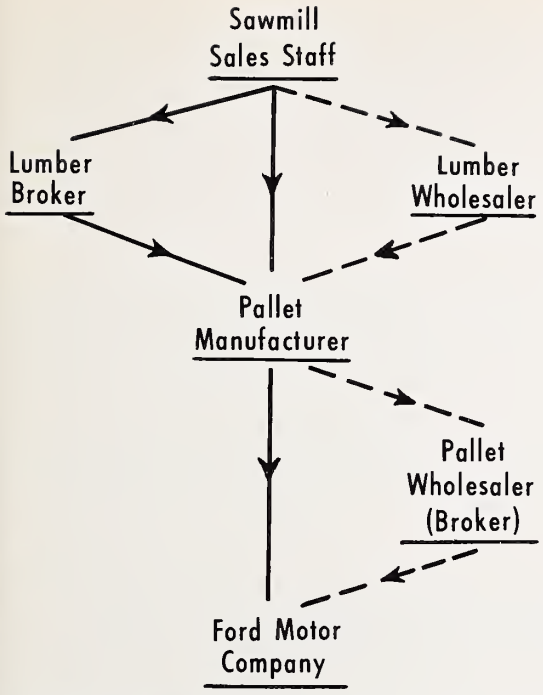

FIGURE 3. — Marketing channels in the automotive pallet industry.

pallet manufacturer selling directly to the automotive industry may own one or more sawmills. These mills may either produce high-quality lumber for the furniture market and use the low-grade hardwoods developed in their regular sawing operation for pallets, or be employed specifically to cut mill run material for pallet manufacture.

Pallets are sold to the auto companies by manufacturers or by pallet wholesalers (called "brokers") or by a combination of the two. In general the large, self-sufficient pallet manufacturers prefer to deal directly with the auto companies through their own sales staffs. Occasionally one will sell pallets to a broker who services an automotive account which for one reason or another cannot be serviced by the manufacturer. As a general statement, however, one might say that the bulk of the durable warehouse pallets are sold through pallet manufacturers, with the pallet broker entering the market to a greater degree in the expendable pallet field.

• • • PALLET PURCHASING METHODS AND THE CONSUMPTION CYCLE

Prior to accepting bids from a pallet maker, the auto company purchasing agent determines whether the pallet plant's capacity is great enough to warrant negotiating a contract. Although plant capacity, either owned or controlled, determines the ability of the pallet manufacturer to enter into a contract with the auto company, price and service determine who gets the contract. Price is the deciding factor, all other things being equal. There have been instances where a special pallet was designed by one firm but the contract to build it awarded to another because of a few cents difference in price.

Contracts for pallets may be made for a period of 3 or 6 months. In general, both the purchaser and manufacturer prefer the 3-month period, since price increases are difficult to negotiate if pallet manufacturing costs increase. The shorter period enables the pallet manufacturer to renegotiate his price sooner, meanwhile relying on his lumber inventory to help him through the contract period if lumber prices increase drastically.

Blanket purchase orders are made for pallets as well as for most other quantity purchases in the auto industry. These are essentially purchase orders which apply for the entire contract period. The blanket order states the number of pallets that the producer may expect to supply each month to the auto company; then the division or divisions using the particular pallet will issue a release for a certain number each week or for whatever period is chosen. This system reduces the amount of paper work required by both pallet manufacturer and auto company, since new purchase orders need not be processed each time a new quantity of pallets is needed. Furthermore, because he knows the sizes of lumber needed for future production, the pallet manufacturer may plan his work more economically.

Prices are based on delivery at the auto company plant or shipping point. Records are kept by the purchasing agent of the performance of each supplier, and delivery delays may cause the supplier to be removed from the approved list of bidders.

Sales in the pallet industry in the Detroit area characteristically fluctuate with the month-to-month production of cars and trucks. Production of new cars swings into high gear in November of each year about a month after the new models are introduced, and increases until January. Characteristically, auto sales fall off at the first of the year and lag until March or April when they spurt ahead. Sales drop rather steeply in the summer months until new models are once again introduced. Pallet consumption follows this same pattern.

Summer is not necessarily a slack season for all pallet manufacturers. The storage program for engines and parts for the new fall models keeps many plants busy.

Sales of pallets also depend upon how often completely new vehicle models are introduced. Auto sales for a given company are usually higher the first year after a complete model change. Consequently pallet use will be highest in the first year of production of the redesigned model and will fall off as minor revisions are made in succeeding models.

Pallet manufacturers develop business outside of the auto industry in an attempt to mitigate the influence of these production cycles. But supplying the auto industry is a special field in itself, stressing design and service and requiring a large plant capacity to meet peak sales. Manufacturers catering to the auto industry are quite dependent upon it.

FUNCTIONS OR SERVICES PERFORMED BY THE PALLET MAKER • • •

Some functions now performed by the pallet industry were assumed by the auto companies in the past. Ford Motor Company, in fact, made its own pallets until 1956. The trend for the auto companies, however, is to shed such side lines and concentrate on auto building.

Pallet Storage and Delivery

As communities surround auto manufacturers and new plants are built, space soon becomes a limiting factor and must be devoted to manufacturing facilities. More and more suppliers are being asked to store such things as pallets and skids in their own yards, supplying them to the auto company on a regular or "as needed" basis.

Since pallet shortages are certain to occur, a premium is placed on service. Successful pallet manufacturers must have the capacity and transportation to produce and ship pallets at a moment's notice, by working overtime if necessary. In emergencies, some firms can give 2-day service but this is expensive. Ford usually releases (orders) pallets 2 weeks to a month ahead of time which gives the plant an opportunity to schedule its work and produce more economically.

Transportation of Lumber

Truck transportation is employed for lumber for pallets except for that shipped by rail from the South. Lumber cut in Michigan may be trucked by a sawmill directly to the pallet plant, or to a central point from which it is hauled by the pallet manufacturer to his own plant. Transportation charges are included in the sale price of the lumber or pallet. The greater part of lumber shipped by railroad is priced on a point of destination basis. Transportation charges on lumber sent from the South by railroad car are usually paid by the pallet manufacturer and deducted from the total charges listed on the invoice; the balance is then remitted to the wholesaler (broker) or sawmill.

Designing and Testing Pallets

Another function performed by the pallet manufacturer is that of designing pallets for special purposes. Most pallets are of prosaic design and are developed by auto company engineers, but approximately 10 percent of the designing is done by the pallet manufacturer. The smaller the vendor of automotive parts, the more the pallet manufacturer aids in designing pallets for the prospective buyer.

Methods for palletizing goods are communicated throughout the auto industry by the pallet manufacturers and suppliers of parts. Therefore pallet design and use have a tendency to be standardized throughout the industry, depending on the equipment and methods used by the auto companies for handling comparable parts.

The pallet manufacturer participates in testing his new product. Frequently he receives a new auto part, makes a pallet for it, and sends the pallet to the auto manufacturer. Next the pallet is usually service-tested, or it may be tested in a laboratory. If the initial tests are satisfactory, the pallet is accepted on a limited basis until production experience proves it to be completely acceptable.

• • • TRENDS IN PALLET USE

Many of the factors affecting warehouse pallet consumption also affect expendable pallet consumption. Others affect only one type of pallet.

For Storage

Pallet manufacturers and material handling engineers alike feel that the use of durable pallets in supply depots and assembly plants by the auto companies has probably reached a saturation point with the present plant arrangement and equipment. Future plants might make more provision for warehouse or re-usable pallets than have assembly plants recently completed, but it is unlikely. New plants do have more storage space for pallets than those constructed years ago, but as long as old plants are in use material handling methods must take old space requirements into account. This retards the conversion to pallets that might otherwise occur. No appreciable expansion in the use of warehouse pallets for storage is expected in the next few years.

For Shipping

Re-usable containers, including wirebound boxes and metal cargo carriers and racks as well as wood warehouse pallets and bins, constantly compete with expendable containers for shipping the same materials. This competition is important because re-usable containers reduce the total quantity of wood used in pallets. When metal containers are used, the relationship is obvious. But wood consumption also decreases when re-usable wood warehouse pallets are employed for shipping. Why? Because three expendable pallets have as much wood in them as one warehouse pallet, but a well-constructed wood pallet can be expected to survive more than three trips to the assembly plant. Therefore, the total lumber consumption per vehicle should decrease if additional durable wood pallets are used.

The freight rate is the primary factor influencing the type of pallet used. In October 1956 the railroads entered into a new agreement with the auto companies which permitted the auto company to ship the container freight-free for the round trip provided it fits the railroad's classification. This means that the re-usable container or pallet became much more attractive and was often substituted for the expendable wooden pallet, causing a decrease in wood used for this purpose (fig. 4).

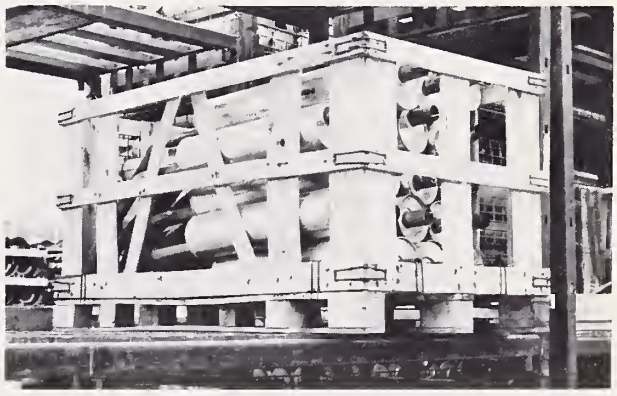

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FIGURE 4. — Palletized wooden crates used for shipping mufflers to the assembly plant. Once empty, these containers are returned to the fabricating plant for re-use.

Nevertheless, the use of durable pallets has a limit. The assembly plants were designed to use expendable pallets so they lack the space required to store returnable containers. Morever, the assembly plant may scrap the re-usable pallet by mistake, thereby increasing pallet expense.

There are other complications in using returnable pallets: first, it becomes necessary to keep records on the units. This means that inventories must be made periodically and that the quantities needed at a plant must be constantly controlled. Second, arguments over ownership of the pallet may occur between the auto company and the supplier of the parts placed on these pallets. In general, if there is a doubt as to which pallet is best, the expendable pallet is chosen.

Future expendable pallet use is difficult to gauge. Pallet manufacturers say that the industry is not saturated with these items and that their use will continue to increase. Ford material handling engineers agree but say that such limiting factors as plant design, model changes, and customer preference for variety and the attendant increased number of parts will control the use of expendable pallets.

The amount of wood used in pallets will depend also upon the design of new cars. When smaller cars are produced, less shipping materials are needed. The design of the part itself is important. If parts nest well, fewer pallets are required.

A change in materials used for expendable pallets would probably result in a substitution of paper for wood with perhaps less wood fiber being consumed. The encroachment of such competition on lumber use is certainly possible. Shipments of vehicle parts on paper or fiber pallets are now being received in assembly plants, though the application is relatively small. An advantage favoring use of paper pallets is the ease of disposal. Scrap paper can be saved, baled, and marketed whereas scrap lumber is costly to burn and difficult to sell. A disadvantage is that paper pallets are not strong enough to be filled with heavy parts and stacked for storage.

CONCLUSIONS • • •

After considering the factors affecting pallet use in the auto industry, it appears that the consumption of wood in pallets per vehicle assembled will remain fairly constant for the next few years. This prediction assumes that competing materials will not make significant inroads. But additional total consumption of wood for pallets is expected because the industry predicts that car and truck production will expand as population increases. Pallet consumption is expected to increase at about the same rate as vehicle production and will provide a growing market for hardwood.

Automobile companies must have reliable suppliers with sufficient capacity to give prompt service. Under the present purchasing policies of the major auto companies, pallet manufacturers are encouraged to increase the size of their plants.

The pallet industry serving the auto companies is extremely competitive. The price and quality of a pallet manufacturer's product, his ability to design efficient, low-cost pallets, and the service he gives must all be excellent if he is to survive and expand his markets.

SOME RECENT STATION PAPERS

LAKE STATES FOREST EXPERIMENT STATION

The Climatic Distribution of Blister Rust on White Pine in Wisconsin, by E. P. Van Arsdel, A. J. Riker, T. F. Kouba, V. E. Suomi, and R. A. Bryson. Sta. Paper 87, 34 pp., illus. 1961.

Forest Recreation in the Upper Great Lakes Area: Proceedings of a Seminar on Research Needs, May 11-13, 1961. Sta. Paper 89, 104 pp., illus. 1961.

Wisconsin's Forest Resources, by Robert N. Stone and Harry W. Thorne. Sta. Paper 90, 52 pp., illus. 1961.

Field Calibration of a Neutron-Scattering Soil Moisture Meter, by Richard S. Sartz and Willie R. Curtis. Sta. Paper 91, 15 pp., illus. 1961.

Growing White Pine in the Lake States to Avoid Blister Rust, by Eugene P. Van Arsdel, Sta. Paper 92, 11 pp., illus. 1961.

Farm Lumber Consumption and Use Data: Needs and Methods of Estimating, by Allen L. Lundgren and Ronald I. Beazley. Sta. Paper 93, 20 pp., illus. 1961.

Pulpwood Production in Lake States Counties, 1960, by Arthur G. Horn. Sta. Paper 94, 28 pp., illus. 1962.

Small Private Forest Landowners in Michigan's Upper Peninsula — Characteristics, Ownership Attitudes, and Forestry Practices, by Dean N. Quinney. Sta. Paper 95, 20 pp., illus. 1962.

Contracting for Forest Aerial Photography in the United States, by Gene Avery and Merle P. Meyer. Sta. Paper 96, 37 pp., illus. 1962.

Three Pine Release Experiments in Northern Minnesota, by Robert E. Buckman and Allen L. Lundgren. Sta. Paper 97, 9 pp., illus. 1962.

Proceedings of the Fifth Lake States Forest Tree Improvement Conference. Sta. Paper 98, 42 pp. 1962.

Three Growing Stock Density Experiments in Minnesota Red Pine — A Progress Report, by Robert E. Buckman. Sta. Paper 99, 10 pp., illus. 1962.

Identification of Conifer Insects by Type of Tree Injury, Lake States, by H. J. MacAloney and D. C. Schmiege. Sta. Paper 100, 41 pp., illus. 1962.

Forest Insects and Diseases in the Northern Great Plains — A Survey, by Louis F. Wilson. Sta. Paper 101, 28 pp., illus. 1962.

Growth Through Agricultural Progress